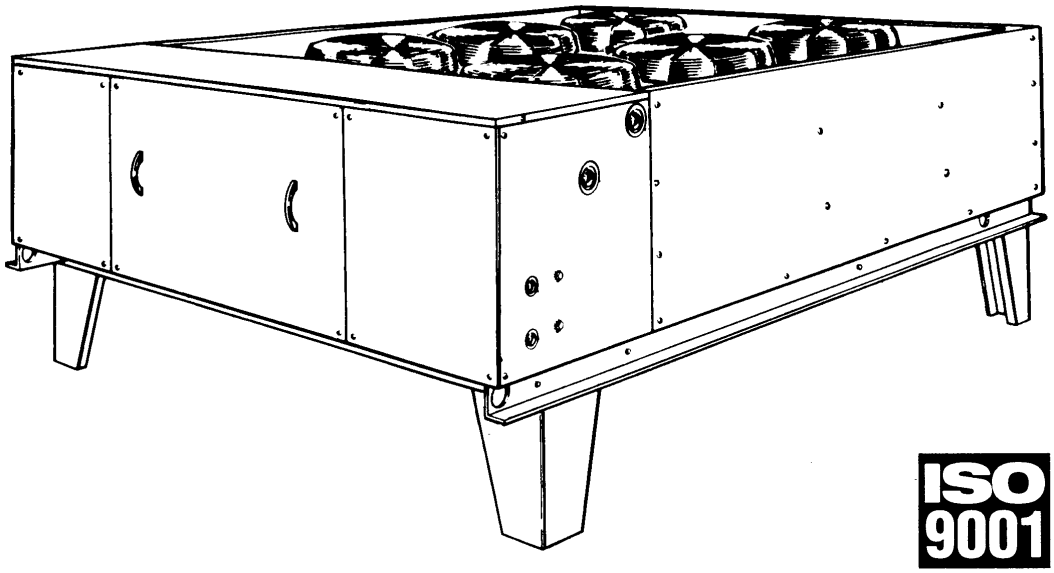
CHAMPION SPLIT-SYSTEM CONDENSING UNITS (AIR COOLED)

INSTALLATION INSTRUCTION | Supersedes: 550.13-N4 (492) | 550.13-N4Y (500)

035-09563-000

MODELS H2CA480 & 600



ISO 9001 CERTIFIED

GENERAL

CHAMPION units are designed for outdoor installation on a roof or at ground level. Every unit is completely packaged, piped and wired at the factory. Each unit is dehydrated, evacuated, leak tested and pressure tested at 450 psig before being pressurized with a holding charge of refrigerant-22.

All controls are located in the front of the unit and are readily accessible for maintenance, adjustment and service. All wiring (power and control) can be made through the bottom of the unit.

REFERENCE

This instruction covers the installation and operation of the basic condensing unit and interconnecting refrigerant mains. For information on the installation of the matching evaporator blower unit, refer to the following instructions:

Model LEU480 - Form 550.13-N8
Model LEU600 - Form 550.13-N9

Refer to Parts Manual for complete listing of replacement parts on this equipment.

The above form and any other forms referenced in this instruction may be ordered from:

Standard Register
Norman, OK 73069
Toll Free: Tel. 877-318-9675/Fax. 877-379-7920

INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing. See Form 50.15-NM for additional information.

CAUTION
THIS PRODUCT MUST BE INSTALLED IN STRICT COMPLIANCE WITH THE ENCLOSED INSTALLATION INSTRUCTIONS AND ANY APPLICABLE LOCAL, STATE, AND NATIONAL CODES INCLUDING, BUT NOT LIMITED TO, BUILDING, ELECTRICAL, AND MECHANICAL CODES.

WARNING
INCORRECT INSTALLATION MAY CREATE A CONDITION WHERE THE OPERATION OF THE PRODUCT COULD CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

Installer should pay particular attention to the words: *NOTE, CAUTION* and *WARNING*. Notes are intended to clarify or make the installation easier. Cautions are given to prevent equipment damage. Warnings are given to alert installer that personal injury and/or equipment damage may result if installation procedure is not handled properly.

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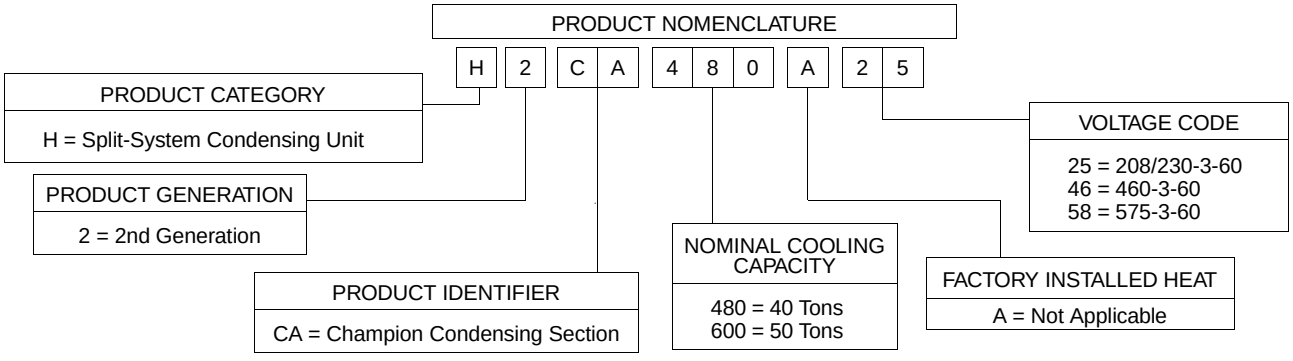


INSTALLATION

LIMITATIONS

These units must be installed in accordance with all national and local safety codes. If no local codes apply, installation must conform with the appropriate national codes. See Table 1 for Application Data. Units are designed to meet National Safety Code Standards. If components are to be added to a unit to meet local codes, they are to be installed at the dealer's and/or the customer's expense.

TABLE 1 - APPLICATION DATA

Model H2CA	Power Supply	Voltage[1] Variation Min. / Max.	Ambient Air on Condenser (°F) Min. / Max.	Saturation Suction Temp. of Gas at Compressor (°F) Min. / Max.
480A25	208/230-3-60	187 / 253	0 / 115	32 / 53.5
480A46	460-3-60	414 / 506		
480A58	575-3-60	517 / 633		
600A25	208/230-3-60	187 / 253		
600A46	460-3-60	414 / 506		
600A58	575-3-60	517 / 633		

[1] Rated in accordance with ARI Standard 110, utilization range "A".

LOCATION

Use the following guidelines to select a suitable location for both the condensing unit and the evaporator.

1. The condensing unit is designed for outdoor installation only.
2. The condenser fans are the propeller type and are not suitable for use with ductwork in the condenser air stream.
3. The condensing unit and the evaporator should be positioned to minimize the number of bends in the refrigerant piping.
4. The condensing unit should be as close to the evaporator as practical.
5. The condensing unit should not be installed where normal operating sounds may be objectionable.
6. The evaporator should be located within the building, either outside or inside the conditioned space.

In addition to the above steps, refer to General Installation Instructions, Form 55.70-N1.

ROOF-TOP LOCATIONS

Be careful not to damage the roof. Consult the building contractor or architect if the roof is bonded. Choose a location with adequate structural strength to support the unit.

The condensing unit must be mounted on level supports. The supports can be channel iron beams or wooden beams treated to reduce deterioration.

A minimum of two (2) beams are required to support each unit. The beams should: (1) Be positioned perpendicular to the roof joists. (2) Extend beyond the dimensions of the section to distribute the load on the roof. (3) Be capable of adequately supporting the concentrated loads at the corner legs. See Figure 1.

These beams can usually be set directly on the roof. Flashing is not required.

NOTE: On bonded roofs, check for special installation requirements.

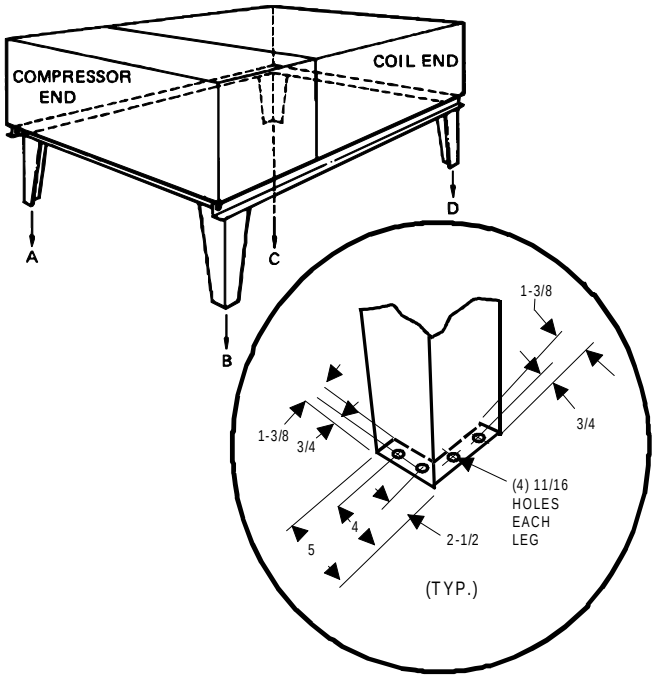


FIG. 1 - LOCATION OF BOLT HOLES AND WEIGHT DISTRIBUTION

Unit	Leg (Lbs.)				Operating Weight (Lbs.)
	A	B	C	D	
HCA480	735	735	405	405	2280
HCA600	930	775	500	395	2600

GROUND LEVEL LOCATIONS

It is important that the units be installed on a substantial base that will not settle, causing strain on the refrigerant lines and possible leaks. A one-piece concrete slab with footers that extend below the frost line is recommended. The slab should not be tied to the building foundation as noises will telegraph.

Ground level units can also be supported by concrete piers. These piers should (1) extend below the frost line, (2) be located under each of the section's four corner legs, and (3) be sized to carry the load of the corner leg it supports. See Figure 1.

On either rooftop or ground level installations, rubber padding can be applied between the legs and their supports to lessen any transmission of vibration.

Holes are provided in the supporting legs for bolting the unit to its foundation. See Figure 1 for the location and dimensions of these bolt holes.

For ground level installations, precautions should be taken to protect the unit from tampering and unauthorized persons from injury. Screws on access panels will prevent casual tampering. Further safety precautions such as a fenced enclosure or locking devices on the panels may be advisable. Check local authorities for safety regulations.

CLEARANCES

The units must be installed with sufficient clearance for air to enter the condenser coil, for air discharge and for servicing access. See Table 2.

NOTE: Additional clearance is required to remove the compressor out the left side of the unit, unless a means is available to lift the compressor out through the top of the unit.

TABLE 2 - MINIMUM CLEARANCES

Clearance Description	Distance In Inches
Overhead (Top)	120
Front (Access Cover)	40
Rear	12
*Left side	18
*Right side	18

*If it is necessary to place one side of the unit against a wall, an additional 24 inches of height must be added to the unit supporting legs.

In all installations where snow accumulates and winter operation is expected, additional height must be provided to insure normal condenser air flow.

RIGGING

Exercise care when moving the unit. Do not remove any crating until the unit is near the place of installation.

SPREADERS SHOULD BE USED BETWEEN SLINGS TO PREVENT CRUSHING THE FRAME OR PANELS.

When preparing to move the unit, always determine the center of gravity of the unit in order to equally distribute the weight. Slings connected to the compressor end of a unit will usually have to be made shorter, so the unit will lift evenly (see Figure 2).

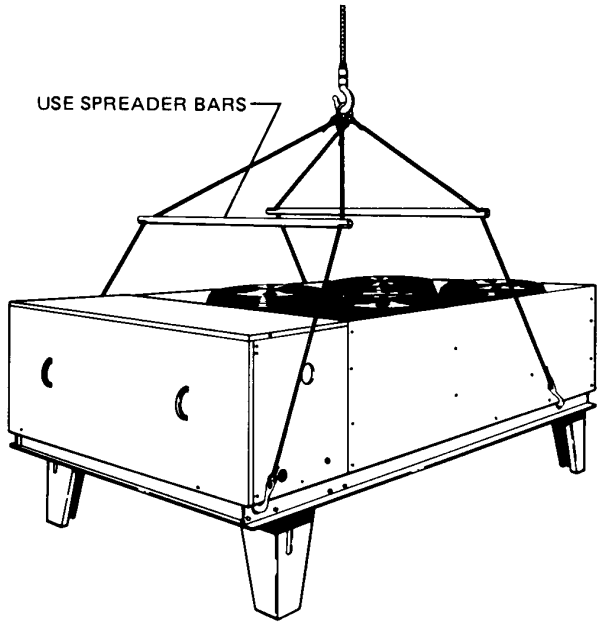


FIG. 2 - TYPICAL RIGGING

Rig units by attaching chain or cable hooks to the holes provided on the base rail.

The length of the spreader bars must exceed the width of the unit. If the unit skid has not been removed, the unit can be lifted with slings. Refer to Table 3 for unit weights.

INSTALLING SUPPORT LEGS

After the unit is in desired location, remove the unit supporting legs which are secured inside the unit compressor compartment. The attached small parts bag containing the hardware for mounting the unit supporting legs should also be removed. Next, lift the unit high enough to remove the unit bottom skid, which is secured by six shipping bolts.

CAUTION: The unit should be firmly supported before beginning installation of the legs.

Keeping the flanges facing towards each other, secure the legs in place with hardware from the small parts bag.

COMPRESSOR HOLD-DOWN NUTS

For shipping, the compressor hold-down nuts are tightened, drawing the mounting feet down to the shipping stops. After the unit is in its final position, the four hold-down nuts must be removed to insert the rubber grommets found in the small parts bag. Replace the hold-down nuts and tighten until they start to compress the isolator springs and then give them an additional half turn.

POWER WIRING

Check the available power and the unit nameplate for like voltage. Run the necessary number of properly sized wires to the unit. Provide a disconnect switch and fusing as required. Route the conduit through the large knockout located on the bottom of the electrical box. See Table 4 for Electrical Data.

The disconnect switch may be bolted to the side of the unit but not to any of the removable panels; this would interfere with access to the unit. Make sure that no refrigerant lines will be punctured when mounting the disconnect switch, and note that it must be suitable for outdoor installation.

WARNING: All power and control wiring must be in accordance with National and local electrical codes.

CONTROL WIRING

Route the necessary low voltage control wires from the terminal block (4TB) on the side of the condensing section control box to the thermostat or the electronic control panel (whichever is applicable) and to the evaporator fan motor controller. Refer to Figures 3 and 4 for field wiring diagrams. Terminal block (2TB) is provided in the control box to accommodate the wiring from the evaporator solenoid valves. The condensing unit fan and control circuit is fused.

COMPRESSOR CRANKCASE HEATERS

The compressors are equipped with crankcase heaters to prevent the migration of refrigerant to the compressors. The heaters are energized only when the unit is not running.

If the main switch is disconnected for long periods of shut down, do not attempt to start the unit for 8 hours after the switch has been re-connected. This will allow sufficient time for all liquid refrigerant to be driven out of the compressor.

TABLE 3 - PHYSICAL DATA

Model	Compressor[1]			Condenser											Unit Weight (Lbs.)		Oper. Charge, (R-22) (Lbs.)	Pump Down Cap.[4] R-22 (Lbs.)
				Fan (Propeller)				Fan Motors[3]		Coil (Copper Tube - Aluminum Fin)								
	Nom. Cap. (Tons)	No. of Cyl.	Stages of Cap.	Qty.	Dia. (In.)	Pitch (Deg.)	Nom. CFM	HP	RPM	Face Area (Ft.^{2})	Rows Deep	Rows Wide	Tube OD (in.)	Fins per inch	Ship.	Oper.		
HCA480																		
Sys. 1	20	4	2	3[2]	24	30	16,050	3/4	1075	30.0	3	36	3/8	12	2,430	2,280	15.0	31
Sys. 2	20	4	2	3[2]			16,050			30.0	3	36					15.0	31
HCA600																		
Sys. 1	20	4	2	3[2]			14,400			25.0	4	30			2,770	2,600	16.5	33
Sys. 2	30	6	3	4[2]			19,400			35.0	4	42					24.0	49

[1]All compressors are semi-hermetic.
[2]During low ambient conditions, the motor for one of these fans will operate at 450 RPM.
[3]These PSC motors are directly connected to the condenser fans and have inherent protection, ball bearings and a 48 frame. Their rotation is clockwise when viewing the shaft end of the motor.
[4]Based on a 115°F ambient temperature.

TABLE 4 - ELECTRICAL DATA

Model		Compressor				Condenser Fan Motors				Unit Ampacity (Amps)	Max. Fuse Size (Amps)	Min. Wire Size (75°C)[3]	
		Power Supply	Qty.	RLA	LRA	Power Supply	HP	Qty.	FLA (each)			CU	AL
HCA480	A25	208/230-3-60	2	66 each	222[1] each	208/230-1-60	3/4	4 2	4.2 4.5	173	225	00	0000
	A46	460-3-60	2	33 each	187 each	460-1-60	3/4	4 2	2.3 2.5	88	110	3	2
	A58	575-3-60	2	27 each	135 each	460-1-60[2]	3/4	4 2	2.3 2.5	74	100	4	3
HCA600	A25	208/230-3-60	1 1	66 105	222[1] 340[1]	208/230-1-60	3/4	5 2	4.2 4.5	227	300	0000	300 MCM
	A46	460-3-60	1 1	33 53	187 283	460-1-60	3/4	5 2	2.3 2.5	115	150	2	0
	A58	575-3-60	1 1	27 40	135 230	460-1-60[2]	3/4	5 2	2.3 2.5	93	125	3	1

[1]Based on part winding start.
[2]A transformer is furnished to reduce the voltage from 575 to 460 volts.
[3]All wire sizes are AWG except where noted.

REFRIGERANT MAINS

Many service problems can be avoided by taking adequate precautions to provide an internally clean and dry system and by using procedures and materials that conform with established standards.

Use hard drawn copper tubing where no appreciable amount of bending around pipes or other obstructions is necessary. If soft copper is used, care should be taken to avoid sharp bends which may cause a restriction.

Pack fiber glass insulation and a sealing material such as permagum around refrigerant lines where they penetrate a wall to reduce vibrations and to retain some flexibility.

Support all tubing at minimum intervals with suitable hangers, brackets or clamps.

Braze all copper to copper joints with Silfos-5 or equivalent brazing material. Do not use soft solder.

Insulate all suction lines with a minimum of 1/2" ARMAFLEX or equal. Liquid lines exposed to direct sunlight and/or high temperatures must also be insulated.

Never solder suction and liquid lines together. They can be taped together for convenience and support purposes, but they must be completely insulated from each other.

A soft solder joint on the condenser header serves as a safety.

Each system contains three service stop valves, one on the compressor suction, one on the compressor discharge and one on the liquid line out of the coil. All three of these valves are the back seating type and are supplied with 1/4" male flare access connections. When fully open, a 1/4 to 1/2 turn in the clockwise direction allows line pressure to these connections for pressure check, etc. (Through the 1/4 inch access connection.)

The liquid and suction connections permit leak testing, evacuation, and partial charging of the field piping and the evaporator without disturbing the condenser coils during initial installation.

Before beginning installation of the mains, be sure that the unit has not developed a leak in transit. Remove the liquid valve flare nut and crack the valve. If pressure still exists in the system, it can be assumed to be leak free. DO NOT release the holding charge.

A filter-drier MUST be field-installed in the liquid line of every system to prevent dirt and moisture from damaging the system. Two properly-sized filter-driers are shipped with each condensing section.

NOTE: Installing a filter-drier does not eliminate the need for the proper evacuation of a system before it is charged.

A moisture indicating sight-glass may be field installed in the liquid line(s) between the filter-drier and the evaporator coil. The moisture indicating sight-glass can be used to check for excess moisture in the system or used as a visual means to verify refrigerant charge.

The stop valve in the liquid line ahead of the filter-drier and the suction valve permit replacing the expansion valve or the drier without loss of refrigerant.

The suction connection to the compressor is sealed with a copper disc brazed over the end of the suction line. *DO NOT REMOVE THE CONDENSING UNIT HOLDING CHARGE.* The liquid connection is 7/8" OD with a cap on the liquid line stop valve. Use a standard radius ell to bring the line out through the grommet.

Plastic grommets, used on the refrigerant lines where they pass through the casing, should be protected from the heat of brazing when the lines are attached.

Wrap the gormmet and adjacent pipe with a wet rag while brazing or temporarily move the grommet by sliding along the refrigerant line.

The temperature required to make or break a brazed joint is sufficiently high to cause oxidation of the copper unless an inert atmosphere is provided.

THEREFORE, DRY NITROGEN SHOULD FLOW THROUGH THE SYSTEM AT ALL TIMES WHEN HEAT IS BEING APPLIED AND UNTIL THE JOINT HAS COOLED.

Connect a supply of dry nitrogen through a reducing regulator to the liquid valve access connection.

Remove the evaporator holding charge and any caps or discs on the liquid and suction connections that will not permit a free flow of nitrogen.

ALWAYS DRILL A SMALL HOLE IN SEALING CAPS AND DISCS BEFORE UNBRAZING TO PREVENT THE PRESSURE IN THE LINE FROM BLOWING THEM OFF.

The refrigerant suction and liquid lines can be piped from either side of the evaporator coil section.

The evaporator coil section is shipped with the side panels suitable for right end piping connections when viewed from the return air ends of the section.

If left end piping connections are required, the large and the small panels on the right side of the coil section can be interchanged with the single panel on the left side. The narrow panel has the holes for the four refrigerant lines and the condensate drain line.

When left end piping connections are installed, both suction lines must be insulated to prevent moisture from condensing on these lines and being carried into the blower section.

Grommets are supplied by the factory for field mounting in the holes provided in the narrow panel. These grommets are shipped in the same carton with the five copper connections.

Begin the refrigerant mains by installing the liquid line from the condensing unit liquid stop valve to the evaporator liquid connection, maintaining a flow of nitrogen during all brazing operations. The filter-drier and sight glass must be located in this line, close to the evaporator.

Make the suction line connection at the evaporator and run the line to the condensing unit.

After drilling the sealing caps, unbraze the condensing unit suction disc and connect the line, still maintaining a flow of nitrogen from the liquid valve access connection through the liquid line to the evaporator, through the evaporator, back to the condensing unit and out the suction valve access connection.

Solenoid and hot gas bypass valves (if used) should be opened manually or electrically during brazing or evacuating. See Form 550.13-N6 for installation of hot gas bypass.

LINE SIZING

When sizing refrigerant pipe for a split-system air conditioner, check the following:

1. Suction line pressure drop due to friction.
2. Liquid line pressure drop due to friction.
3. Suction line velocity for oil return.
4. Liquid line pressure drop due to vertical rise.

Tables 5 and 6 list friction losses for both the suction and liquid lines on the condensing section. For certain piping arrangements, different sizes of suction line pipe may have to be used. The velocity of the refrigerant vapor must always be great enough to carry the oil back to the compressor.

Evaporator Below Condensing Section - On a split system where the evaporator blower is located below the condensing section, the suction line must be sized for both pressure drop and for oil return. See Table 5.

Condensing Section Below Evaporator - When the condensing section is located below the evaporator blower, the liquid line must be designed for the pressure drop due to both friction loss and vertical rise. See Table 6. If the pressure drop due to vertical rise and friction exceeds 40 psi, some refrigerant will flash before it reaches the thermal expansion valve.

Flash gas:

1. Increases the liquid line pressure loss due to friction which in turn causes further flashing.
2. Reduces the capacity of the refrigerant control device which starves the evaporator.
3. Erodes the seat of the refrigerant control device.
4. Causes erratic control of the refrigerant entering the evaporator.

EVACUATION AND CHARGING

Determine the required weight of refrigerant using Table 3, Physical Data, and Table 7 Refrigerant Line Charge. Table 3 includes operating charge based on the unit plus 25 feet of refrigerant lines. Table 7 includes data required to adjust the charge for line lengths other than 25 feet.

With the liquid and discharge valves remaining closed (front seated), open the suction valve halfway. Connect a vacuum pump through a charging manifold to both the liquid connection on the liquid valve and the suction connection on the suction valve. Vacuum pump connection lines should be short and no smaller than 3/8" OD.

The refrigerant mains and the evaporator may now be evacuated without disturbing the condenser coils.

After proper evacuation and dehydration, charge the required weight of liquid refrigerant into the liquid access connection.

CAUTION: Do not charge liquid refrigerant through the compressor suction connection.

Open the Liquid and Discharge valves fully. Open the suction valve to within 1/4 turn.

Start the compressor and continue to charge refrigerant gas through the suction access connection.

CAUTION: Never operate the compressor while under a deep vacuum.

If proper equipment is not available for weighing in the refrigerant charge a moisture indicating sight glass may be used to aid in charging the unit.

After proper evacuation and dehydrating of the unit, charge the unit as described above until the moisture indicating sight glass is clear. Add approximately 2 extra pounds of refrigerant to a 20 ton system and three pounds to a 30 ton system to assure a liquid refrigerant seal at the expansion valve under all operating conditions. If necessary, block the flow of condenser air to assure a head pressure of 280 psig during the charging operation.

CAUTION: Never operate the compressor while under a deep vacuum.

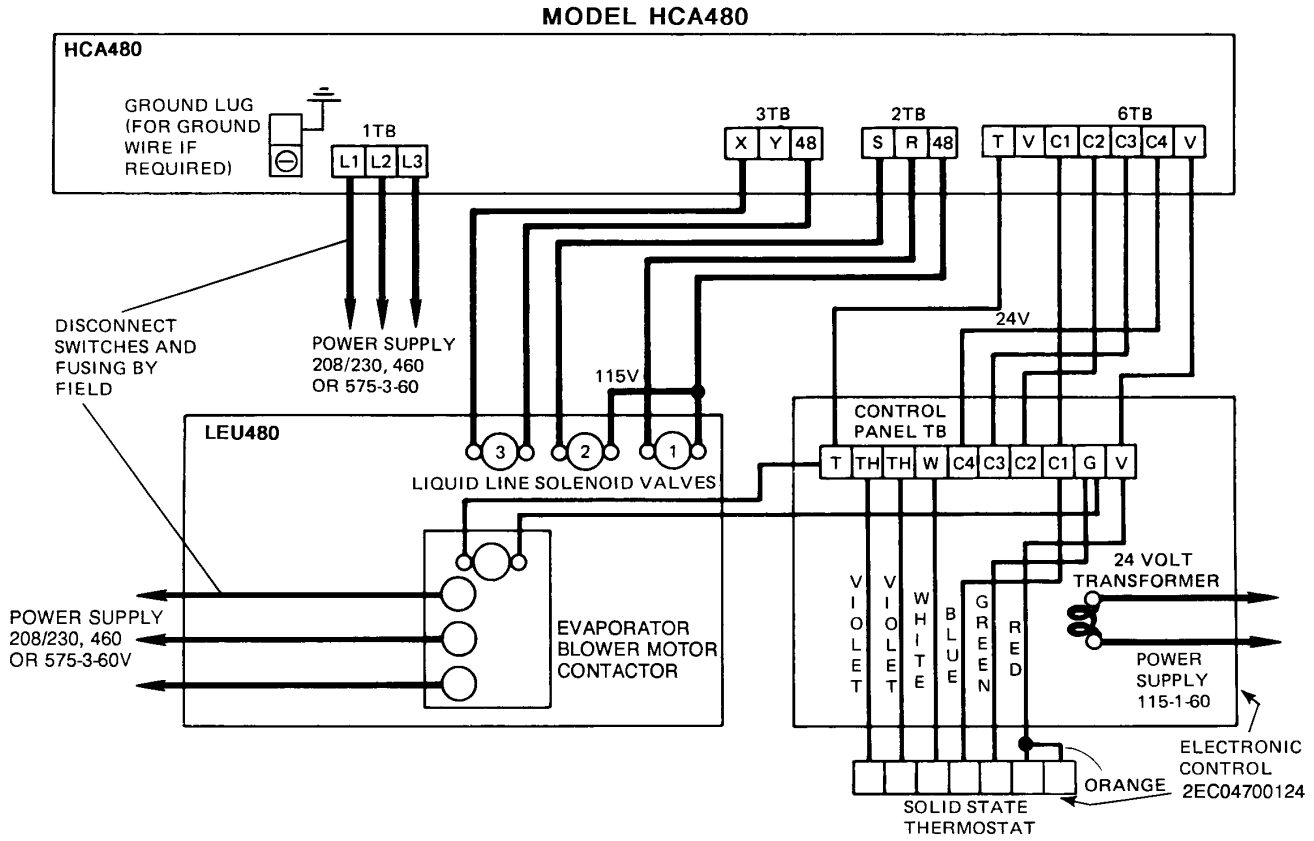


FIG. 3 - FIELD WIRING - MODEL HCA480

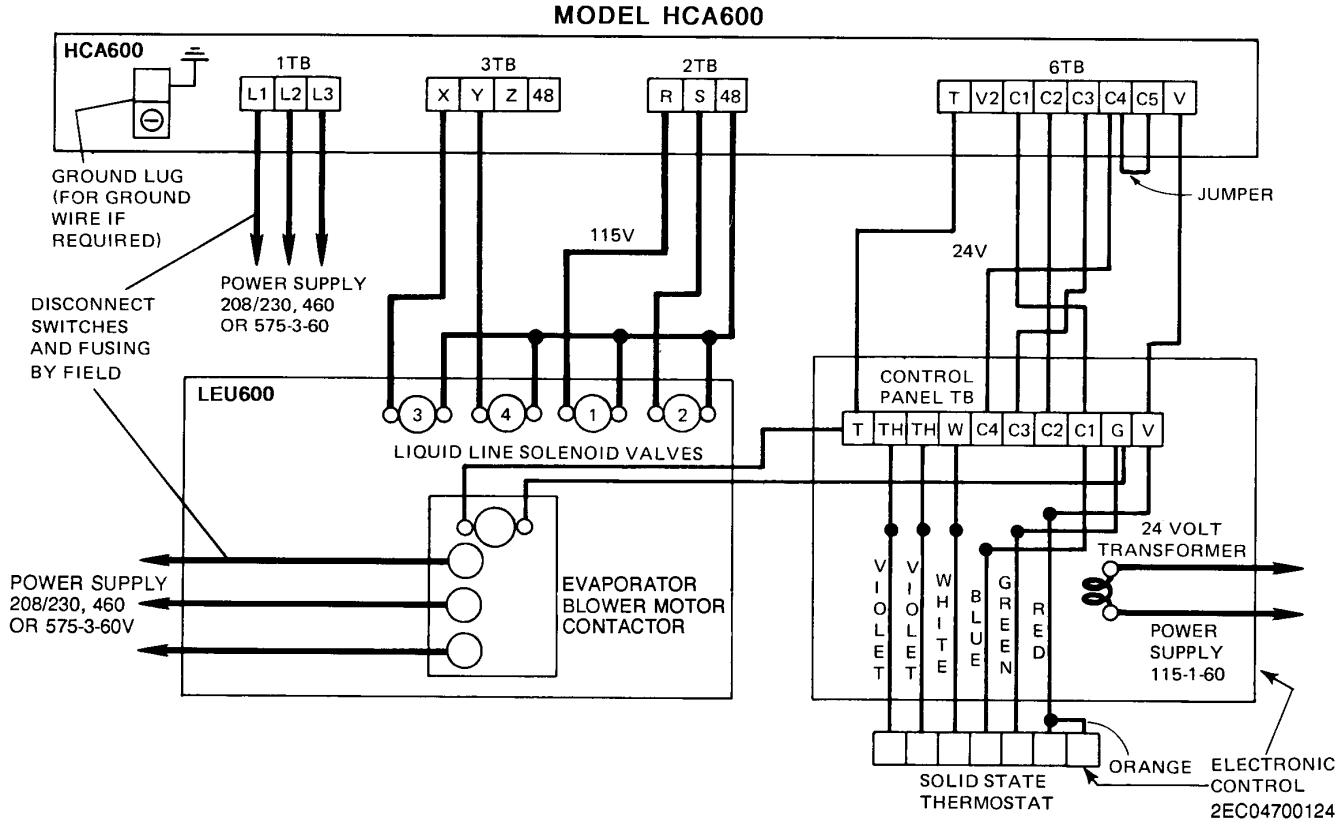


FIG. 4 - FIELD WIRING - MODEL HCA600

TABLE 5 - SUCTION LINES [1,2,3]

Model Designation				Nominal Capacity (Tons)	Refrigerant Flow Rate[4] (Lbs./Min.)	Type L Copper Tubing (Inches,O.D.)	Refrigerant Gas Velocity (Ft./Min.)	Friction Loss[5,6] (PSI/100 Ft.)
HCA480	System #1		Full Capacity	20	60	1-5/8 2-1/8 2-5/8	3120 1800 1200	4.3 1.2 0.4
			Half Capacity	10	30	1-5/8 2-1/8 2-5/8	1560 900[7] 600[7]	1.2 0.3 0.1
	System #2		Full Capacity	20	60	1-5/8 2-1/8 2-5/8	3120 1800 1200	4.3 1.2 0.4
			Half Capacity	10	30	1-5/8 2-1/8 2-5/8	1560 900[7] 600[7]	1.2 0.3 0.1
HCA600	System #1		Full Capacity	20	60	1-5/8 2-1/8 2-5/8	3120 1800 1200	4.3 1.2 0.4
			Half Capacity	10	30	1-5/8 2-1/8 2-5/8	1560 900[7] 600[7]	1.2 0.3 0.1
	System #2	Single Riser	Full Capacity	30	90	2-1/8 2-5/8 3-1/8	2700 1800 1260	2.3 0.8 0.4
			2/3 Capacity	20	60	2-1/8 2-5/8 3-1/8	1800 1200 840[7]	1.2 0.4 0.2
			1/3 Capacity[8]	10	30	2-1/8 2-5/8 3-1/8[10]	900[7] 600[7] -	0.3 0.1 -
		Double Riser[9]	Full Capacity	30	90	A (1-5/8) B (2-1/8)	1560 1800	1.2 1.2
			2/3 Capacity	20	60	A (1-5/8) B (2-1/8)	1020 1200	0.6 0.6
			1/3 Capacity	10	30	A (1-5/8) B (2-1/8)[11]	1560 -	1.2 -

[1]All horizontal suction lines should be pitched at least 1 inch every 20 feet in the direction of the refrigerant flow to aid the return of oil to the compressor.

[2]All suction lines with a vertical rise exceeding 50 feet should be trapped at the midpoint. This trap will provide a drainage point for the oil which is in the riser when the circuit is de-activated. When the circuit is re-activated, the oil will be returned to the compressor more quickly and in smaller slugs.

[3]Every vertical suction riser greater than 3 feet in height should have a “P” trap at the bottom to facilitate the return of oil to the compressor.

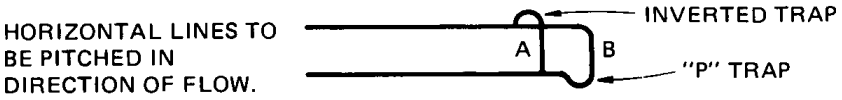
[4]Based on Refrigerant-22 at the nominal capacity of the HCA unit (or system), a suction temperature of 40°F and a liquid temperature of 105°F.

[5]Although suction lines should be sized for a friction loss equivalent to a 2°F change in saturation temperature (or approximately 3 psi), sizing the lines for the proper return of oil is more important.

[6]These friction losses do not include any allowances for valves or fittings.

[7]Since the refrigerant gas velocity may be too low to maintain good oil return up a vertical riser, use the next smaller size. The larger size may be used for horizontal runs for a lesser pressure drop.

[8]When a 30-ton compressor can operate at 1/3 capacity and the evaporator coil is located at a lower elevation, the system must have a double suction riser as shown below to provide the proper return of oil to the compressor.



[9]These line sizes only apply to the vertical risers; refer to the single riser table for horizontal runs.

[10]Tubing size of 3-1/8" OD is too large for both vertical risers and for horizontal runs at 10 tons.

[11]The gas velocity up the two risers at 1/3 capacity will be too low to carry any oil, and oil will collect in the “P” trap at the bottom of riser “B”. After an oil seal is formed, the gas velocity up riser “A” will be able to carry oil.

TABLE 6 - LIQUID LINES

Model Designation		Nominal Capacity (Tons)	Refrigerant Flow Rate[1] (Lbs./Min.)	Type L Copper Tubing (Inches, O.D.)	Pressure Drop[3]	
					Friction[2] (PSI/100 Ft.)	Vertical Rise (PSI/Ft.)
HCA480	System #1	20	60	3/4 7/8 1-1/8	8.0 3.6 1.0	0.50
	System #2	20	60	3/4 7/8 1-1/8	8.0 3.6 1.0	0.50
HCA600	System #1	20	60	3/4 7/8 1-1/8	8.0 3.6 1.0	0.50
	System #2	30	90	7/8 1-1/8	7.4 2.1	0.50

[1]Based on Refrigerant-22 at the nominal capacity of the unit (or system), a liquid temperature of 105°F and a suction temperature of 40°F.
[2]These friction losses do not include any allowances for a strainer, filter-drier, solenoid valve, isolation valve or fittings.
[3]The total pressure drop of the unit (or system) for both friction and vertical rise must not exceed 40 PSI. If the pressure drop exceeds 40 PSI, the liquid refrigerant could flash before it reaches the expansion valve. This flashing will not only cause erratic valve operation and poor system performance, but could also damage the expansion valve.

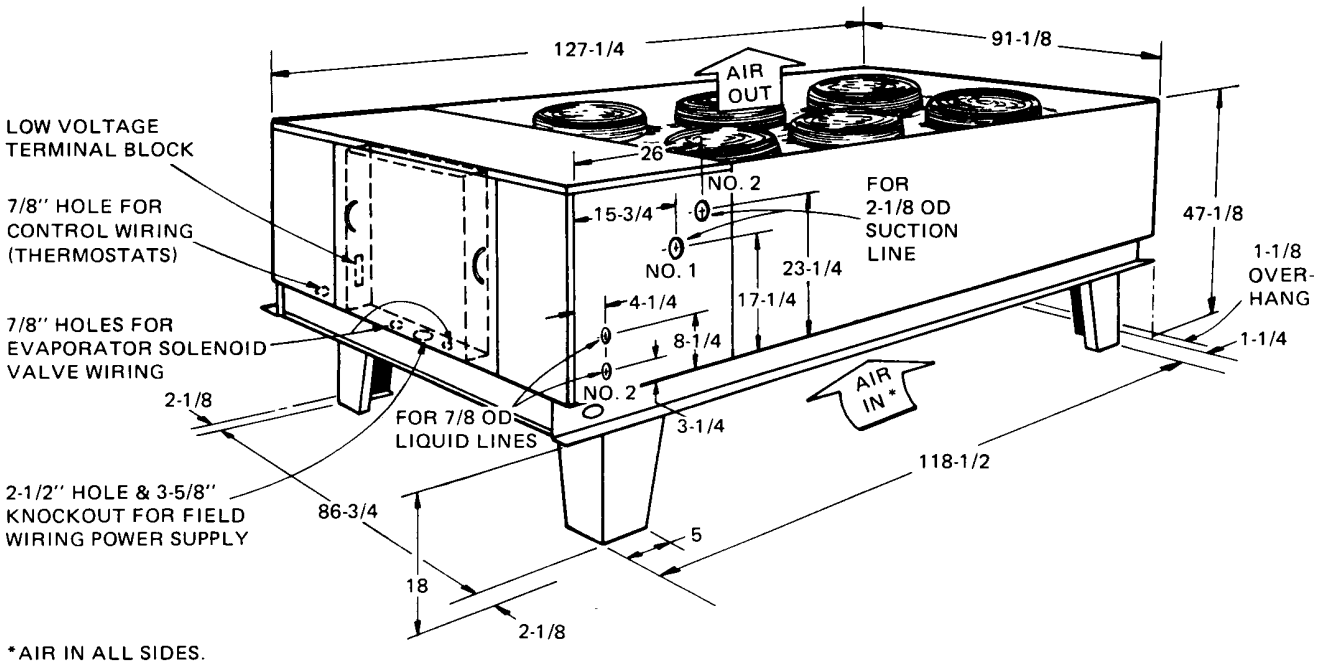
TABLE 7 - REFRIGERANT-22 LINE CHARGE[1]

Liquid Line[2] Inches, O.D.	3/4	0.167 lb./ft.
	7/8	0.236 lb./ft.
	1-1//8	0.403 lb./ft.
Suction Line[2] Inches, O.D.	1-5/8	0.019 lb./ft.
	2-1/8	0.033 lb./ft.
	2-5/8	0.050 lb./ft.
	3-1/2	0.072 lb./ft.

NOTE: Add the operating charge of the HCA unit, the evaporator coil and the refrigerant lines to determine the total refrigerant charge of the system.
[1]Charges are based on 40°F suction temperature and a 105°F liquid temperature.
[2]Type “L” copper tubing.

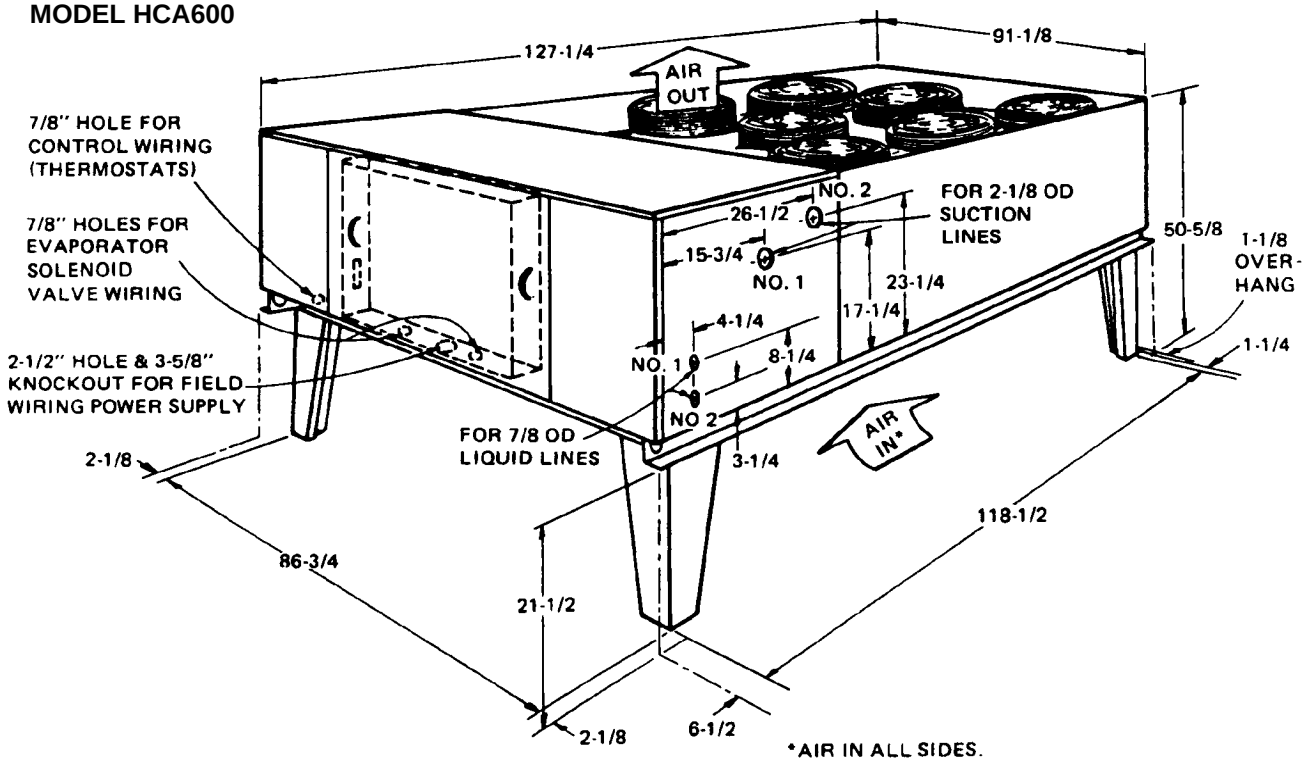
UNIT DIMENSIONS

MODEL HCA480



*AIR IN ALL SIDES.
IF NECESSARY TO PLACE ONE SIDE OF SECTION AGAINST WALL, 12" EXTRA HEIGHT MUST BE ADDED TO SUPPORTING LEGS TO OBTAIN PROPER AIR FLOW.

MODEL HCA600



*AIR IN ALL SIDES.
IF NECESSARY TO PLACE ONE SIDE OF SECTION AGAINST WALL, 24" EXTRA HEIGHT MUST BE ADDED TO SUPPORTING LEGS TO OBTAIN PROPER AIR FLOW.

OPERATION

NOTE: The timing intervals described in the following procedures are nominal. Some variations will naturally occur due to differences in individual components, or due to variations in ambient temperature or line/control voltage. Refer to the wiring labels inside of the unit control access panel for additional information.

SEQUENCE OF OPERATION

1. Upon a call for cooling at terminal C1 (on terminal block 6TB), relay 5R is energized. Contact 5R-1 energizes compressor No. 1 protection module 1MP, which closes contact 1MP. Contact 5R-2 closes, energizing contactors 1M and 5M, relay 1R, and timer 1TR. Contact 5R-3 closes, causing liquid line valve 1LLS to open, allowing refrigerant to flow to the TXV and evaporator.

2. Relay 1R contacts close, with 1R-1 and 1R-2 closing in parallel with contacts 5R-1 and 5R-2 respectively, maintaining operation during the pumpdown cycle. (Refer to Step 10.)

3. Contactor 1M energizes the compressor (or the first half of the windings for 208/230V units with Part Winding Start). The contactor 1M auxiliary switch 1M-AUX opens, de-energizing the crankcase heater during compressor operation for improved efficiency. Contactor 5M energizes the condenser fans. The various condenser fans operate provided the ambient is above the individual setpoints of the temperature controls 1TH and 2TH.

4. After 1 second, timer 4TR closes, energizing contactor 2M and the second half of the compressor windings (Part Winding Start provided for 208/230V units only).

5. After 10 seconds, timer 3TR closes, (providing the discharge pressure is sufficiently low to close pressure control 2HP), energizing condenser fan No. 3.

6. If the compressor oil pressure fails to rise to a normal level within 90 seconds, oil pressure control 1OP contact 2TR opens, stopping operation. The oil pressure control requires manual reset at the unit to resume operation.

7. After 2 minutes, low pressure bypass timer 1TR opens. If the compressor suction pressure remains abnormally low after initial start-up, the compressor circuit will lock out as described in Step 14.

8. Upon an additional call for cooling at terminal C2 (on terminal block 6TB), relay 2R energizes, opening the liquid line valve 2LLS, and de-energizing the compressor unloader solenoid 2SOL. This sequence is typical for two banks of unloading on the HCA600 30-ton compressor.

9. As the C2 call for cooling is satisfied, liquid line valve 2LLS closes, and unloader 2SOL is energized, unloading one cylinder bank for part load operation.

10. As the C1 call for cooling is satisfied, relay 5R de-energizes, causing its contacts 5R-1, 5R-2 and 5R-3 to open. The liquid line valve 1LLS closes, initiating the pumpdown cycle. Compressor operation is maintained only by relay 1R at this point.

11. As the compressor suction pressure falls sufficiently to open pressure control 1LP, all contactors and relays de-energize, stopping operation.

12. The control system No. 2 for compressor No. 2 functions the same as that for compressor No. 1 described above. Slight variations exist between HCA480 and HCA600 units due to the additional cylinder unloader circuit found on the HCA600 six cylinder compressor, but otherwise the control sytems are identical.

13. The compressor is protected by a solid-state protection module in conjunction with thermisters imbedded in the motor windings. Additionally, the module contacts 1MP open in the event the 120V control system drops below 85V, or if power is interrupted for more than 0.2 seconds. Since the module is not part of the lockout circuit, operation will resume automatically after 2 minutes. Since relays 1R and 5R interrupt power to the module in every off cycle, it prevents short-cycling.

14. During normal operation, should either pressure control 1HP or 1LP open, the high-impedence relay 1LOR will energize preventing further operation, even after the pressure controls re-close, due to the open contact 1LOR-1. Contact 1LOR-2 closes, providing 24VAC at the external lockout alarm terminal X1.

    NOTE: Each compressor has a separate lockout alarm terminal (X1 and X2) for individual external alarms, although terminals X1 and X2 may be wired to a single external lockout alarm if desired.

    The lockout condition will continue until relay 5R is reset via terminal C1. During the first 2 minutes of operation, while the 1LP bypass contacts 1TR are closed, the low pressure control 1LP will not initiate lockout.

    NOTE: The compressor module is not in the lockout circuit.

    Should the module stop operation due to overcurrent, low voltage or power interruption, the unit will not lock out, but will automatically reset after 2 minutes as described in Step 13.

OPERATION WITH A TWO-STAGE THERMOSTAT

If the total system is to be controlled with a 2-stage thermostat:

1. Terminals C1 and C2 on low voltage block 6TB of the HCA600 should be connected with a jumper to provide one stage of 20 tons, and

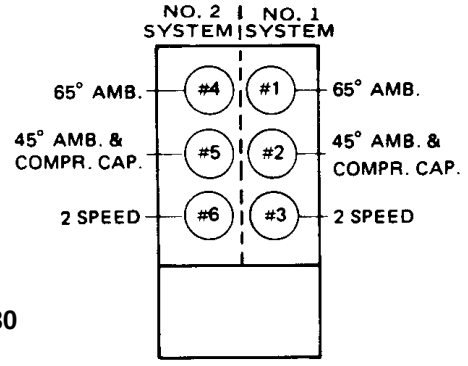
2. Terminals C3, C4 and C5 on low voltage block 6TB of the HCA600 should be connected with jumpers to provide a second stage of 30 tons.

COMPRESSOR MOTOR PROTECTION SYSTEM

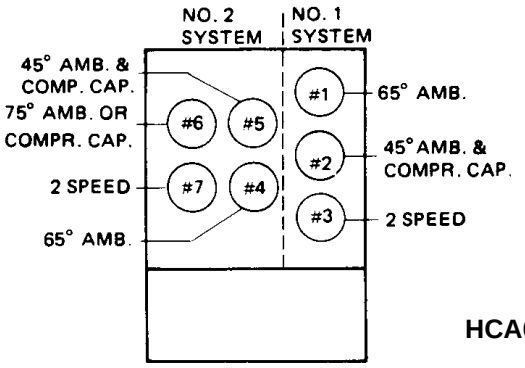
The solid state motor protection system consists of a solid state overload protector module, Robertshaw MP23, and three sensors (ES11) embedded in the compressor motor windings. The sensors are connected to the solid state overload protector (module 1MP for the 20-ton compressor and 2MP for the 30-ton compressor). See Wiring label on Control Box Door.

OPERATION

As the motor winding temperature rises, the resistance of the three sensors increases. If safe temperatures are exceeded, the electronic device will open its relay contact and will shut down the compressor. After the motor cools to a safe temperature, the compressor can restart provided the anti-cycle timer has completed its cycle.



HCA480



HCA600

CONDENSER FAN MOTOR CONTROL

Condenser fan motors cycle with capacity and with the temperature of the outdoor air to maintain sufficient head pressure for stable operation over a wide range of conditions. One condenser fan motor per compressor can operate at a reduced speed without overheating. Motor speed is reduced from 1075 to 450 RPM when the discharge pressure of a system drops below 180 psig. The motors return to full speed when the pressure rises above 222 psig. This reduction in speed is obtained by using a choke coil to reduce the voltage to the motor. 10 second time delay relays are included in the control circuit so these motors will always start at high speed.

EXAMPLE - HCA480

NO. 1 (20-TON) SYSTEM - Under 65°F, the No. 1 condenser fan will shut off. Under 45°F, the No. 2 condenser fan will shut off. At 1/2 capacity, the No. 2 condenser fan will shut off. When the discharge pressure drops below 180 psig, high pressure control 2HP will close to energize relay 3R. When contact 3R-1 opens and contact 3R-2 closes, condenser fan No. 3 will be powered through choke coil 1CH and its speed will drop to 450 RPM. Timer 3TR will remain open for 10 seconds after start-up so condenser fan No. 3 will always start at high speed.

NO. 2 (20-TON) SYSTEM - Under 65°F, the No. 4 condenser fan will shut off. Under 45°F, the No. 5 condenser fan will shut off. At 1/2 capacity, the No. 5 condenser fan will shut off. When the discharge pressure drops below 180 psig, high pressure control 4HP will close to energize relay 10R. When contact 10R-1 opens and contact 10R-2 closes, condenser fan No. 6 will be powered through choke coil 2CH and its speed will drop to 450 RPM. Timer 7TR will remain open for 10 seconds after start-up so condenser fan No. 6 will always start at high speed.

EXAMPLE - HCA600

NO. 1 (20-TON) SYSTEM - Under 65°F, the No. 1 condenser fan will shut off. Under 45°F, the No. 2 condenser fan will shut off. At 1/2 capacity, the No. 2 condenser fan will shut off. When the discharge pressure drops below 180 psig, high pressure control 2HP will close to energize relay 3R. When contact 3R-1 opens and contact 3R-2 closes, condenser fan No. 3 will be powered through choke coil 1CH and its speed will drop to 450 RPM. Timer 3TR will remain open for 10 seconds after start-up so condenser fan No. 3 will always start at high speed.

NO. 2 (20-TON) SYSTEM - Under 65°F, the No. 4 condenser fan will shut off. Under 45°F, the No. 5 condenser fan will shut off. At 2/3 capacity, the No. 6 condenser fan will shut off if the ambient temperature is below 75°F. At 1/3 capacity, the No. 5 condenser fan will shut off. When the discharge pressure drops below 180 psig, high pressure control 4HP will close to energize relay 10R. When contact 10R-1 opens and contact 10R-2 closes, condenser fan No. 7 will be powered through choke coil 2CH and its speed will drop to 450 RPM. Timer 7TR will remain open for 10 seconds after start-up so condenser fan No. 7 will always start at high speed.

SECURE OWNER'S APPROVAL: *When the system is functioning properly, secure the owner's approval. Show him the location of all disconnect switches and the thermostat. Teach him how to start and stop the unit and how to adjust temperature settings within the limitations of the system.*

MAINTENANCE

CLEANING CONDENSER SURFACE

Dirt should not be allowed to accumulate on the condenser coils or other parts in the condenser air circuit. Clean as often as necessary with a brush, vacuum cleaner attachment or other suitable means.

LUBRICATION

These Champion fan motors are equipped with factory lubricated and sealed ball bearings. They do not require any maintenance.

COMPRESSOR REPLACEMENT

Obtain replacement compressor or parts from your local Copeland Wholesaler. See Instruction Form 55.72-RD2.2 for replacement compressor reference data..

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